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The Effects of Sports Specialization and Injury Rates in Collegiate Athletes

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ABSTRACT

BACKGROUND: Sport specialization has been thought to cause burnout, overuse injuries, and isolation within a pediatric population. PURPOSE: The purpose of this study was to examine the effects of sports specialization in collegiate athletes. METHODS: Twenty fourth-year athletes at The University of Akron (age 22.1 ±.72 yrs.) chose to participate in the study. Athletes were provided with a survey regarding high school sport participation, and informed consent was obtained to access their collegiate medical records. NExTT© database was used to collect data on the number of injuries each participant sustained while in collegiate athletics. The number of sports played in high school was then compared with the participants number of injuries throughout their collegiate career. RESULTS: Only 30% of participants specialized in high school. The injuries rates of those who specialized demonstrated no significant change from their counterparts who played multiple sports. CONCLUSION: Based on the results, sports specialization in high school does not significantly affect the rate of injury in collegiate athletics.

LITERATURE REVIEW

Sport specialization is a highly debated topic in the realm of athletics and health care. Numerous studies have been conducted regarding sports specialization, how it affects athletes, and when it can be helpful. There is speculation that sports specialization causes an increase in overuse injuries. However, there are still many areas that lack research. One of the biggest areas that needs further exploration is the long-term effects of sports specialization.

To better understand what is in the future for sports specialization, one must understand what sport specialization is. Sport specialization, as defined by Jayanthi, Pinkham, Dugas, Patrick, and LaBella (2012), is “intense, year-round training in a single sport with the exclusion of other sports” (252). Some variations may exist in definition, but the common theme is intense

training in a single sport. Sluder, Fuller, Griffin, and McCray (2017) provide three components for grading the specialization of an athlete. The first is training for eight or more months per year. The second is focusing on a single main sport. The last component is quitting all other sports to pursue a single sport. An athlete is considered specialized if they meet one of these, but the more the athlete meets, the more specialized they are considered.

Rates of sport specialization vary widely among sports. One study on collegiate football and field hockey athletes found that only 2.8% specialized in high school (White & Oatman, 2019). Another study on NBA draft picks, however, found that 85% specialized in high school (Rugg, Kadoor, Feeley, & Pandya, 2018). It is impossible to provide an exact percentage of athletes who specialize across all sports. Individual sports that require a high level of technical skills, such as gymnastics, dance, and swim, have been more comprehensively studied than team sports (Rugg, Kadoor, Feeley, & Pandya, 2018). Depending on the sport and whether it is individual or team oriented, different statistics for specialization rates can be found.

The philosophy behind specialization is that an athlete will increase their time spent practicing, conditioning, playing, as well as being coached, and this will translate to improvement in that specific sport (White & Oatman, 2019). Besides improvement within a specific sport, other reasons for specialization include parental expectation, the pursuit of college scholarships, pressure from coaches, stories from elite athletes, and the desire for themselves to become elite as well (Sluder, Fuller, Griffin, & McCray, 2017). Brenner (2007) described specialization as a result from the pressure to obtain a scholarship, make the Olympic team, or "grab a piece of professional pie." Overall, most athletes specialize because of a desire or pressure to pursue higher level athletics.

There is research describing some of the benefits of specialization. One benefit is better coaching and skill instruction for specialized athletes. Most experienced coaches work with players who are specialized, as compared to those focus on a variety of sports. Another benefit is improved time management skills. When specializing in a sport, there is a large time commitment. The athlete must figure out how to complete all their responsibilities while devoting a large amount of time to a single sport, and because of this, they are forced to improve their time management skills (Sluder, Fuller, Griffin, & McCray, 2017).

The research discussing the disadvantages of specialization far outnumbers that of its benefits. The time commitment, even though it improves time management skills, fosters isolation (Sluder, Fuller, Griffin, & McCray, 2017). When elite adolescent athletes focus excessively on a single sport, they limit their time in education, socialization, and the development of other skills necessary in life, such as higher-level social competencies (McKay, Broderick, & Steinbeck, 2016). Another disadvantage is the large financial commitment. There are coaching fees, club memberships, uniforms, equipment, travel expenses, and competition fees. The time commitment and financial burden limits other experiences the athlete can have throughout their life (Sluder, Fuller, Griffin, & McCray, 2017).

One of the biggest disadvantages to sports specialization is the increased risk for burnout. Brenner describes burnout as, “a series of psychological, physiologic, and hormonal changes that result in decreased sport performance” (2007). Burnout is due to overtraining and when athletes begin to perceive that they cannot meet the demands placed on them either physically or mentally (Sluder, Fuller, Griffin, & McCray, 2017). Pressure is often placed on athletes by parents and coaches, but sometimes it may be from themselves as well. This pressure heightens anxiety. The demands placed on the athlete may then play a role in the development of many

disorders, such as depression, chronic fatigue, and substance abuse (McKay, Broderick, & Steinbeck, 2016). Ultimately, the combination of these things leads to withdrawal, then dropout of activities that were previously enjoyable (Sluder, Fuller, Griffin, & McCray, 2017).

The last disadvantage commonly attributed to sport specialization is increased risk for overuse injuries. This has drawn much attention from the medical community. In 2000, the American Academy of Pediatrics took a stance against sports specialization (White & Oatman, 2019). Both the American College of Sports Medicine and the Youth Sports Institute also do not recommend specializing due to the risk for overuse injuries. An overuse injury, according to Sluder et al. (2017), is "(a) negative consequence of repeated microtrauma in a tendon, muscle, or bone associated with chronic repetition of specific sport activity movements" (p. 11). There has been an increase in injuries from sports along with the rise in organized sports. Several sources estimate that there are more than 3.5 million injuries annually for children and adolescents who play sports. Of these injuries, it is estimated that 45.9% to 54% are due to overuse (DiFiori, et al., 2014). This is largely due to the emphasis on skill development, such as kicking, shooting, or pitching, rather than an emphasis on generalized fitness. The emphasis on skill development focuses on repetitive movements, and repetitive movements are a key in both sport specialization and the development of overuse injuries (Rugg, Kadoor, Feeley, & Pandya, 2018). These higher injury rates, often attributed to specialization, will affect the length of an athlete's career (Cote, Lidor, & Hackfort, 2009). In a study of first-round NBA draft picks, the players that were multisport athletes in high school played in a greater percentage of games, and they had fewer injuries that affected participation throughout their career (Rugg, Kadoor, Feeley, & Pandya, 2018).

Despite the benefit of allowing the body to heal, athletes often ignore overuse injuries in order to keep playing. In a study by McKay, Broderick, and Steinbeck, six-percent of athletes believe that it was safe to play with an injury. Fifty-eight-percent were willing to risk doing so anyway, even though they believed it was unsafe. This number jumped to 80% when athletes believed there would be adverse effects on their chance to play for an elite team. Not only is playing a single sport leading to more overuse injuries, athletes are continuing to play through injuries to compete at a higher level.

Overuse injuries often progress over time, unlike acute injuries which happen in a specific instance. In a year-long study of high school athletes, those who specialized were twice as likely to sustain an overuse injury compared to their counterparts who played multiple sports (Howard, 2016). There are four stages of overuse injuries. First, the athlete experiences pain in the affected area after physical activity. Next, there is pain during activity without restricting the athlete's performance. Third, pain is present during activity and it restricts performance. Lastly, the athlete experiences chronic, unremitting pain even at rest (Brenner, 2007). Although this may not be true for every overuse injury, it does demonstrate the build up of microtrauma that does not have time to heal.

Some common overuse injuries that can be seen from sports specialization are tendinitis and stress fractures. Tendinitis is inflammation of a tendon. In addition to the pain that Brenner described for overuse injuries, with tendinitis the athlete may also experience tenderness at the affected area and mild swelling. The repetitive sports movements place stress on the tendon, and this stress increases when improper technique is used. Overtime, this leads to tendinitis, which can progress in severity if not treated properly. Tendinitis can affect any tendon in the body. However, patellar tendinitis and Achilles tendonitis are two of the most common locations

(Tendinitis, 2018). A study of elite figure skaters found that 12% had Achilles tendinitis. Other studies on figure skaters have found the rate of patellar tendinitis to be between eight and twenty-five percent (Han, Geminiani, & Micheli, 2018). Considering figuring skating falls into the category of a highly technical, individual sport, it is a common sport for specialization. Another study based on high school sport specialization found that 20% of new injuries in high school athletes are tendinitis (Howard, 2016).

Stress fractures, like tendinitis, are caused by repetitive forces, and overtime, these forces create a break within a bone (The Cleveland Clinic Foundation, 2018). The bones go through reabsorption at an increased rate due to intense physical activity, and this causes the outer surface of the bone to weaken (Prentice, 2014). Common sites for stress fractures to occur include the tibia and metatarsals. The severity of stress fractures is graded along a scale from I to V, with V being the most severe (Miller, Jamieson, Everson, & Siegel, 2017). Based on the severity, symptoms will vary. However, like most overuse injuries, there may be pain, tenderness, and swelling (The Cleveland Clinic Foundation, 2018). Miller, Jamieson, Everson, and Siegel state that the rate for stress fractures in Division I collegiate track and field athletes can be up to 20% annually. Overall, the likelihood of a stress fracture increases as an athlete becomes more competitive when focusing on one sport (Miller, Jamieson, Everson, & Siegel, 2017).

Despite much research on sports specialization and injury rates, there are still missing pieces that need further investigation. In the multitude of literature, there is a noted link between sports specialization and overuse injuries, as described earlier. However, there is minimal research on how sports specialization in high school affects injury rates in collegiate athletes. More research needs to be done looking into long term effects of sports specialization. The

purpose of this study is to investigate injury rates in collegiate athletes who specialized in high school compared to collegiate athletes who played multiple sports in high school.

METHODS

This study was retrospective and correlational in design. The independent variable was the number of sports an athlete played in high school. The dependent variable was the number of injuries the athlete sustained as a collegiate athlete.

Subjects

The subjects in this study were athletes in their fourth year at The University of Akron. This included true senior athletes as well as red-shirted juniors. Both male and female subjects were included. All participants provided informed consent prior to participation in this study. This study was approved by the Institutional Review Board at the University of Akron prior to beginning.

Testing Procedures

After informed consent was obtained, participants were provided with a survey (Appendix A). The survey was coded via identification numbers so that no identifiable information was present. A participant roster that listed corresponding identification numbers was stored in a passcode protected file. The survey required athletes to record their sport participation from high school along with the number of years in each sport. On the survey, athletes were also asked if they believed their high school participation prepared them for competition at the collegiate level, and they were asked for an estimate of their total number of injuries throughout their collegiate career.

Once the surveys were completed, participants' medical records were accessed under the supervision of the sports medicine staff through NExTT© software from Vivature, Inc. (Dallas,

Texas). For the purpose of this study, all injuries that required documentation by the sports medicine staff were included. Documentation of general medical conditions were also listed in the database, but not included. Injuries and illnesses were listed together, but anything documented as a general medical condition was not included in the count of injuries.

The number of injuries and types of injuries from the NExTT© database were recorded using the same coding as the surveys. The data from the surveys and the injury records were then matched to determine the number of sports played by each participant along with the coinciding number of injuries.

Statistical Analysis

A Pearson product-moment correlation coefficient was used to determine the relationship between the number of sports played in high school and the number of injuries sustained throughout a collegiate athletic career. The *a-priori* level was set at $p<0.05$. The r value was then squared and used to describe the amount of variability in number of collegiate injuries explained by the number of sports played by a participant in high school.

RESULTS

This study had a 23.26% participation rate, with 20 total participants out of a possible 86. The average age of the participants was 22.1 (±.72) years old. The majority of subjects were male, totaling 70% of the entire sample. Subjects played a variety of collegiate sports including basketball, football, soccer, softball, and track and field (Table 1). Soccer athletes made up the largest portion of subjects, comprising 30% of all participants. The majority of athletes played multiple sports in high school with three sports being the most common. Thirty-percent of participants did specialize. The number of participants and the number of sports played in high school is described in Table 2. Sports played in high school included a wide variety, everything

from baseball to flag football. Table 3 describes the sports played in high school and their participation rate.

The Pearson product moment correlation between the number of sports played in high school shared a non-statistically significant weak positive relationship with their number of injuries in their collegiate career, $r = 0.2321$, $p = 0.324781$. A total of 5.387% of the variance in subjects' collegiate injuries is explained by their high school sport participation.

Of specialized athletes, 88.24% of their collegiate injuries were acute in nature. Chronic and unspecific (nature of injury not described on injury report) both made up 5.88% of injuries. Those who played one sport in high school averaged 5.17 (± 3.1885) injuries in college. Those who played two sports averaged 4.33 (±1.5275) injuries. Those who played three sports averaged 6.33 (±3.3166) injuries, and those who played four sports averaged 8 (±9.8995) injuries.

Table 1

Collegiate Sports Participation

Sport	Number of Participants	Percentage (%)
Basketball	2	10.00
Football	4	20.00
Soccer	6	30.00
Softball	5	25.00
Track and Field	3	15.00

Table 2

Number of Sports Played in High School

Number of Sports Played	Number of Participants	Percentage (%)
1	6	30.00
2	3	15.00
3	9	45.00
4	2	10.00

Table 3

Sports Played in High School

Sport Played	Number of Participants	Percentage (%)
Baseball	2	10.00
Basketball	9	45.00
Cross Country	2	10.00
Flag Football	1	05.00
Football	8	40.00
Soccer	7	35.00
Softball	5	25.00
Swimming	1	05.00
Track and Field	8	40.00
Volleyball	3	15.00
Wrestling	1	05.00

DISCUSSION

Despite evidence that specialization is related closely with overuse injuries, the results of this study do not support the hypothesis that this is true for collegiate athletes who specialized in high school. There are multiple possibilities as to why there was not a significant correlation between the injury rates of athletes who specialized in high school compared with those who played multiple sports.

One possible explanation is that the National Collegiate Athletic Association (NCAA) regulates the amount of time collegiate athletes can compete and practice. In accordance with NCAA bylaws, collegiate athletes can only participate in practice and competitions for 20 hours a week, or a maximum of four hours per day. They also are required to have a day off during the playing season. The NCAA also regulates the maximum number of games each team can play and the amount of time they can practice in the off-season (NCAA Academic and Membership Affairs Staff, 2018). The regulation from the NCAA plays a factor in decreasing overtraining in collegiate athletes. Overtraining increases the risk for overuse injuries (Walters, Read, & Estes,

2018). Thereby, NCAA regulation that limits overtraining influences the risk of injury in collegiate athletes.

Another possible explanation for the results is the timing of specialization. A large portion of sports specialization research is targeted for those who are pre-pubescent. Existing research shows that those who play multiple sports have fewer injuries than those who specialized before puberty (Brenner, Joel; Council on Sports Medicine and Fitness, 2016). However, when looking at specialization in high school, most athletes have already entered puberty and are later in the phases of growth and maturation. High school students are traditionally between the ages of 14 and 18 years. Puberty typically begins between the ages of 8 and 14 years for females and 9 and 15 years for males (Blakemore, Burnett, & Dahl, 2010). Athletes in high school may not be affected to the same extent as those who are younger due to their developmental maturity.

This study, as with any study, experienced limitations that may have contributed to the results. The first limitation was the small sample size. Participation was voluntary, so data was collected from a portion of all possible participants. Of the participants that elected to join this study, those who specialized were all from one sport, soccer. As there were not specialized participants from a variety of collegiate sports, the data collected may not accurately reflect the total population. This study was also limited by lack of information of the types of injuries. Many of the injuries were not described in nature, and it is left undetermined if they were chronic or acute.

Future research could incorporate athletes from multiple universities. Research could also aim to collect data from specialized athletes in every NCAA sport for each gender and from athletes who played multiple sports in high school for each NCAA sport in order to improve the

pool of participants and increase variability. Future researchers could also look solely at the rate of overuse injuries, as specialization has been shown to increase the risk in younger populations.

Overall, there is very limited research on the long-term effects of sports specialization and how those who specialize later in life are affected. This study aimed to address how sports specialization in high school affected injury rates in collegiate athletes, as an increase in injuries is one of the main concerns of specialization. However, there was not found to be a significant relationship between the number of sports played in high school and the number of injuries in college.

REFERENCES

Blakemore, S.-J., Burnett, S., & Dahl, R. E. (2010). The Role of Puberty in the Developing Adolescent Brain. *Human Brain Mapping, 31*, 926-933.

Brenner, J. (2007). Overuse Injuries, Overtraining, and Burnout in Child and Adolescent Athletes. *American Academy of Pediatrics, 119*(6), 1242-1245.

Brenner, Joel; Council on Sports Medicine and Fitness. (2016). Sports Specialization and Intensive Training in Young Athletes. *American Academy of Pediatrics*, 138.

Cote, J., Lidor, R., & Hackfort, D. (2009). ISSP Position Stand: To Sample or To Specialize? Seven Postulates about Youth Sport Activities that Lead to Continued Participation and Elite Performance. *International Journal of Sport and Exercide Psychology, 7.1*, 7-17.

DiFiori, J. P., Benjamin, H. J., Brenner, J., Gregory, A., Jayanthi, N., Landry, G. L., & Luke, A. (2014). Overuse Injuries and Burnout in Youth Sports: A Position Statement from the American Medical Society for Sports Medicine. *Clinical Journal of Sports Medicine, 24*(1), 4-20.

Han, J. S., Geminiani, E. T., & Micheli, L. J. (2018). Epidemiology of Figure Skating Injuries: A Review of the Literature. *Sports Health, 20*(10), 1-6.

Howard, B. (2016, December 20). *Injury Rates Higher for Athletes Who Specialize in One Sport.* Retrieved from National Federation of State High School Associations: https://www.nfhs.org/articles/injury-rates-higher-for-athletes-who-specialize-in-one-sport/

Jayanthi, N., Pinkham, C., Dugas, L., Patrick, B., & LaBella, C. (2012). Sports Specialization in Young Athletes: Evidence-Based Recommendations. *Sport Health, 5*(3), 251-257.

McKay, D., Broderick, C., & Steinbeck, K. (2016). The Adolescent Athlete: A Developmental Approach to Injury Risk. *Pediatric Exercise Science, 28*(4), 488-500.

Miller, T. L., Jamieson, M., Everson, S., & Siegel, C. (2017). Expected Time to Return to Athletic Participation After Stress Fracture in Division I Collegiate Athletes. *Sports Health, 10*(4), 340-344.

NCAA Academic and Membership Affairs Staff. (2018, August 1). Division I Manual. 239-318. Indianapolis, Indiana: The National Collegiate Athletic Association.

Post, E. G., Thein-Nissenbaum, J. M., Stiffler, M. R., Brooks, M. A., & Bell, D. R. (2017). High School Sport Specialization Patterns of Current Division I Athletes. *Sports Health, 9*(2), 148-153.

Prentice, W. E. (2014). *Principles of Athletic Training: A Compentency-Based Approach* (15 ed.). New York, New York: McGraw-Hill Inc.

Rugg, C., Kadoor, A., Feeley, B. T., & Pandya, N. K. (2018). The Effects of Playing Multiple High School Sports on National Basketball Association Players' Propensity for Injury and Athletic Performance. *The American Journal of Sports Medicine, 46(2)*, 402-408.

Sluder, J. B., Fuller, T. T., Griffin, S. G., & McCray, Z. M. (2017). Early vs. Late Specialization in Sport. *GAHPERD Journal*, 9-15.

Tendinitis. (2018). (Mayo Foundation for Medical Education and Research) Retrieved July 2018, from Mayo Clinic.

The Cleveland Clinic Foundation. (2018). *Stress Fractures*. Retrieved July 2018, from Cleveland Clinic.

Walters, B. K., Read, C. R., & Estes, A. R. (2018). The Effects of Resistance Training, Overtraining, and Early Specialization on Youth Athlete Injury and Development. *The Journal of Sports medicine and Physical Fitness*, *58*(9), 1339-1348.

White, J., & Oatman, D. (2019). Does Specializing in Team Sports During Childhood Translate Into a College Athletic Career? *Missouri AHPERD Journal*, *19*, 20-24.

APPENDIX A

Participant _____

Injury Rates and Sports Specialization Survey

1. Please indicate which sports you play during high school by checking the box next to it. On the line next to the box, please write the number of years you played this sport during high school.

Number of Years Played

Baseball ☐ _____

Basketball ☐ _____

Bowling ☐ _____

Cross Country ☐ _____

Field Hockey ☐ _____

Football ☐ _____

Golf ☐ _____

Gymnastics ☐ _____

Ice Hockey ☐ _____

Lacrosse ☐ _____

Soccer ☐ _____

Softball ☐ _____

Tennis ☐ _____

Volleyball ☐ _____

Wrestling ☐ _____

Other (specify) ☐ _____

_____

2. Do you feel as if your high school participation prepared you for competition at the collegiate level?

Yes	*No*
☐	☐

3. Please check the box that best describes the number of injuries sustained throughout your time at the University of Akron.

0-5	*6-10*	*11-15*	*15+*
☐	☐	☐	☐